THE SUBTIDAL ALGAL AND SEAGRASS ECOLOGY OF ST FRANCIS ISLAND, SOUTH AUSTRALIA

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Summary

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A subtidal survey of selected sites in the Isles of St Francis off the west coast of Eyre Peninsula, South Australia, shows that upper and mid sublittoral zones similar to those of Pearson I. and West I. occur. The upper sublittoral on rocky coasts is dominated by species of *Corallina* and *Jania*, with *Cystophora intermedia* present near low tide level or sometimes as deep at 3 m. The mid sublittoral is characterised by larger brown algae (*Ecklonia radiata*, *Scytothalia dorycarpa*, and species of *Cystophora* and *Sargassum*), often with an understorey of red algae. The lower sublittoral zone occurred between 47 and 57 m deep on the transect subject to greatest water movement, and is characterised by red algae together with bryozoa, sponges and hydroids.

In the sheltered Petrel Bay, communities of the seagrasses *Amphibolis antarctica* and *Posidonia* occur.

An algal species list is appended.

Introduction

The marine flora of the Great Australian Bight is little known. Apart from the intertidal region, which has been briefly discussed by Womersley & Edmonds (1958), the subtidal region is known only from various drift collections and the ecological account of Shepherd & Womersley (1971) of Pearson Island, towards the eastern limit of the Bight.

An expedition to the Isles of St Francis, lying off Ceduna, supported by the then Fisheries and Fauna Conservation Department and the Royal Society of South Australia, visited the islands from 4–11 January, 1971. This provided the opportunity for a brief survey of the subtidal ecology of selected sites subject to varying degrees of water movement. Although limited in time, these studies provide the first such information from the northern part of the Great Australian Bight.

The Isles of St Francis comprise nine small islands, the largest of which, St Francis I. (Fig. 1) is about 4 km across and lies at 32°31'S, 133°18'E, about 56 km from the mainland. The islands are granitic, rising steeply from the sea-floor, and subtidally the topography consists of massive blocks and sheets of rock. In sheltered areas (e.g. Petrel Bay), the sandy sea-floor slopes more gently into deeper water.

The short stay on the island prevented a detailed survey, but three survey sites were chosen on St Francis I., subject to different degrees of water movement. One site was chosen on nearby Masillon I., and collections were also made at Egg I.

The field work was limited to the subtidal region, but brief observations of the intertidal region indicated that the organisms and zonation present were similar to those described by Womersley & Edmonds (1958) for such granitic steeply sloping coasts.

Methods

The following transects (Fig. 1) were chosen, and in each case the transect ran normal to the coast, from low water level down the slope to the depth where rock was buried by sand, except for transect D which was predominantly on sandy bottom.

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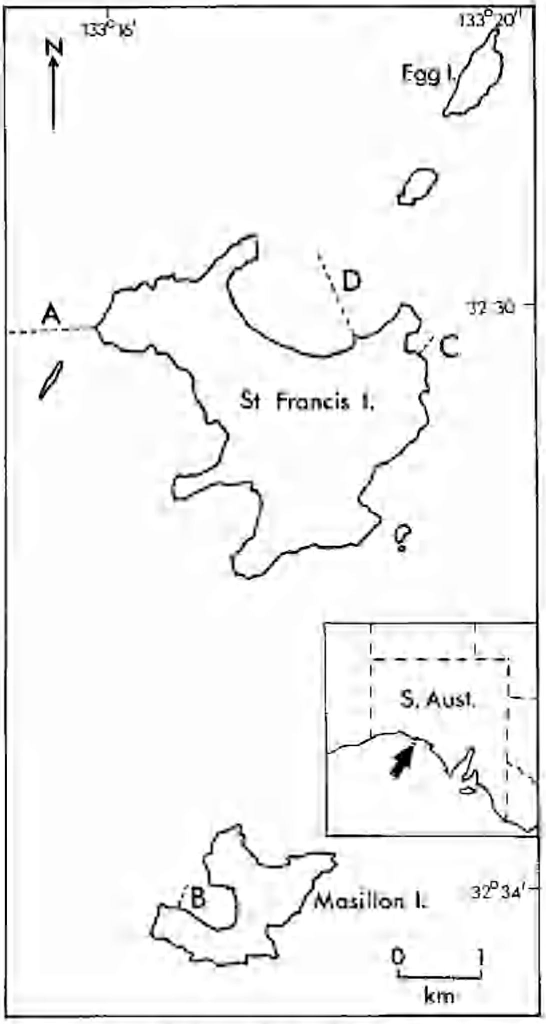

Fig. 1. Map of four of the isles of St Francis showing the position of the four transects (A–D). Inset shows the situation of the islands in the northern Great Australian Bight.

Transect A was on the NW corner of St Francis I., under conditions of strong water movement, and terminated at 57 m depth. A sampling gap (32–38 m deep) in this transect was filled by collections from a similar site on Egg I.

Transect B was on Masillon I., subject to moderate water movement, and terminated at 33 m depth.

Transect C on St Francis I., was subject to relatively slight water movement, and descended to 20 m.

Transect D in Petrel Bay on St Francis I., was the most sheltered site, with a gently sloping, sandy, sea-floor dominated by seagrasses.

On transects A, B and C, the diver first swam about 2 m above the bottom along the transect, estimating the percentage cover and recording the vertical range of the prominent brown algae. This was then repeated on two parallel lines, one each side of the first transect and about 15–20 m distant. Estimates of cover for particular depths are given as the average of these three values, which were made subjectively as a percentage on a scale of 0–10. Many species vary considerably in percentage cover over a horizontal distance of some metres, but the figures given provide an overall assessment of the cover along the transects.

Communities were recognised by the upper stratum dominants, this being the most satisfactory method on such surveys. At the depths studied, algae were dominant except at 50–57 m on transect A, and within each community quantitative samples of the upper stratum were taken for biomass estimates. This was done by counting the plants in a hoop of ⅛ m^2 area, placed sequentially along a horizontal line some 16–24 times, so as to give a total sampling area between 2 and 3 m^2, and the number of plants per m^2 calculated. The average weight of an individual plant was determined by weighing a random sample of 10 plants, and the biomass per m^2 then calculated. The other strata were sampled by means of 4 to 8 sequential samples, each of ⅛ m^2.

On transect D in Petrel Bay, a diver was towed on an underwater sled behind a boat, and the distribution and depth range of the seagrasses were noted, and photographs taken.

The algal samples were preserved in 4% formaldehyde-sea water, and taken to the laboratory for determination and analysis. Biomass figures are based on the wet weight of the preserved collections after removal of surface water. These estimates should be taken as examples only of the size and variation in biomass of the community dominants, since the restricted diving time on a short expedition such as this limits the range of transects, and the number of samples that can be taken. The transect samples were supplemented by other general observations and collections, and by photography.

Depths were measured by capillary and mechanical depth gauges, and the results averaged and adjusted to approximate low tide level.

Environmental factors

The short duration of the survey precluded detailed studies on environmental factors, but the following information is available. The Isles of St Francis rise from a maximum water depth of about 60 m at the southwest of St Francis I. and are comparable to the Pearson Islands in their distance from the mainland and in their topography.

Water movement

St Francis I. is subject to a strong south-westerly swell of 10–12 second period, prevailing throughout the year, similar to that at Pearson I. and West I. (Shepherd & Womersley 1970, 1971). In summer, a short southerly swell is generated by the strong southerly winds which blow for about 12 hours each day and are characteristic of this part of the Great Australian Bight. Wave action on all parts of the islands facing south to west is strong in the intertidal region.

Temperature, salinity and nutrients

Sea surface temperatures range from 18–20°C in summer to 14–15°C in winter, according to Vaux (1970) and data obtained from various oceanographic stations in the vicinity (C.S.I.R.O. 1967a, 1967b, 1968, 1969). In summer, bottom temperatures at 50 m depth are 2–3°C lower than sea-surface temperatures. During the study, the surface temperature was 18°C off the island and about 20°C inshore in Petrel Bay.

Salinity, phosphate, nitrate and oxygen levels are similar to those for Pearson I., viz. salinity 35.6–36.2‰; inorganic phosphate 0.09–0.17 μg atom/litre; nitrate about 0.3 μg atom/litre; and oxygen saturation 93–103%.

Submarine light intensity

Light penetration was not measured, but according to H. Jitts (pers. comm.) it corresponds to that for Type II oceanic water of Jerlov (1968), and is thus only slightly less clear than the waters about Pearson I.

The algal and seagrass ecology

The algal-dominated subtidal photic zone at other localities in South Australia has been found to present three main zones, designated as the upper, mid, and lower sublittoral zones (Shepherd & Womersley 1970, 1971). These zones are also apparent in the areas studied at St Francis I.

Communities of the rocky coast will be described first, including those on both horizontal and sloping rock but not those in crevices or under overhangs, followed by the sea-grass and algal communities of sheltered, sandy areas. The communities studied are essentially those subject to sufficient light intensity to be plant dominated, but prominent animal species are mentioned where present.

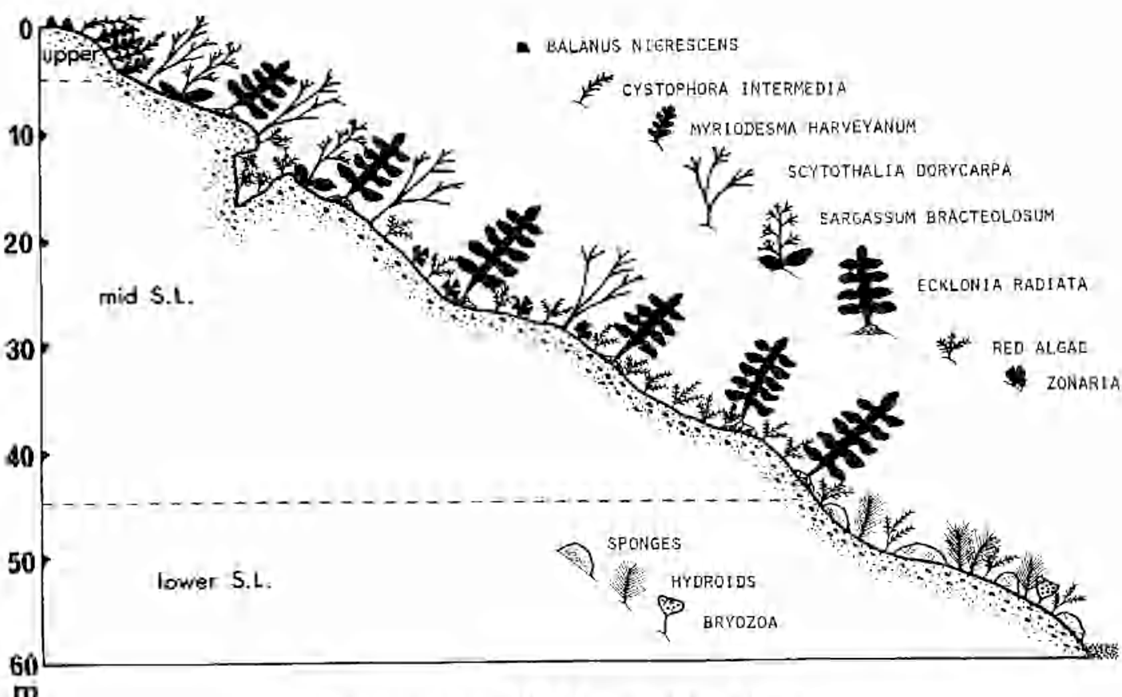

Fig. 2. A vegetation profile of transect A (St Francis I.).

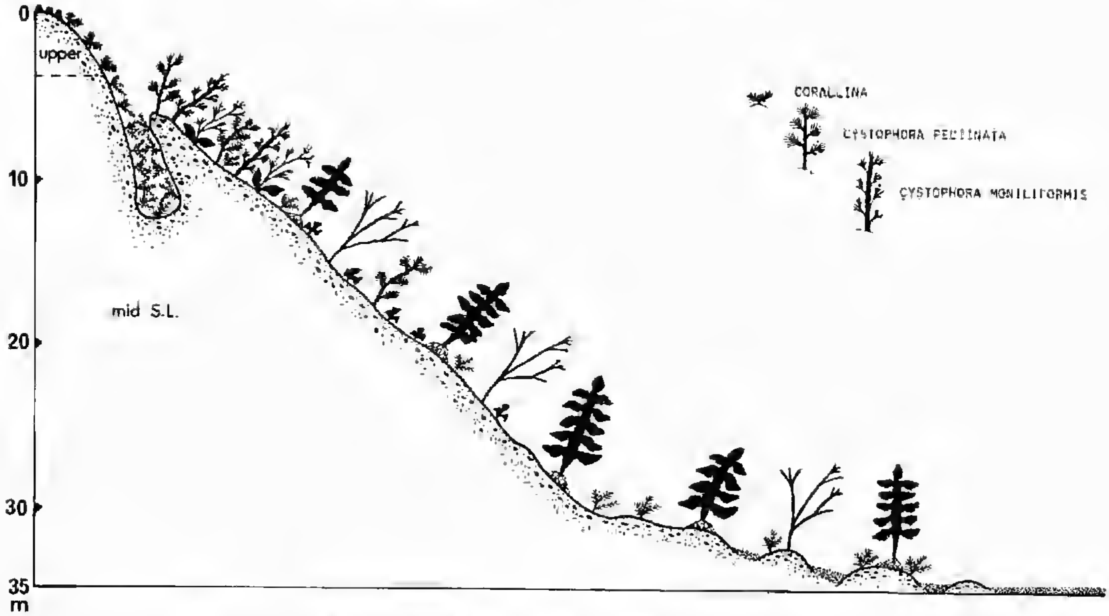

Fig. 3. A vegetation profile on transect B on Masillon I. See legend on Fig. 2 for other algal taxa.

Fig. 4. A vegetation profile of transect C on St Francis I. See legend on Fig. 2 for other algal taxa.

A. ROCKY COASTS

Transects A, B, and C traverse rocky areas, generally steeply sloping and including both horizontal and sloping rock surfaces. The marked light gradient with depth, coupled with the considerable gradient in water movement within each transect (especially A) and also between the transects, gives rise to a fairly distinct zonation of algae. Profiles for transects A, B, and C are given in Figs 2–4, and the depth relationships of the communities to water movement are given in Fig. 5.

1. *Upper sublittoral zone*

This zone is subject to the most intense water movement, and varies in vertical width from 5(–7) m on rough-water coasts (transect A, Fig. 2) to 2(–3) m on sheltered coasts (transect C, Fig. 4). Communities of this zone typically have a single, dense, stratum of fairly uniform height, ranging from 15–20 cm for the *Cystophora intermedia* community to 2–3 cm for the *Jania* community.

Corallina cuvieri, in high-light situations (i.e. especially horizontal surfaces and those facing

TABLE 1

Species and biomass (g/m²) composition of upper sublittoral communities in samples taken at about 1(–1.5) m depth on transects A, B and C. "P" indicates sparse occurrence although not present in sample.

Transect	A	B	C
Area sampled (m²)	0.25	0.25	0.37
Water movement	Strong	Moderate	Slight
Dominant Species			
Cystophora intermedia	**1,280**	P	30
Myriodesma harveyanum	**1,400**		
Corallina cuvieri f. *crispata*		**2,800**	**4,200**
Jania fastigiata			[1,900]*
Other Species			
Caulerpa brownii	70		
Caulerpa papillosa	140		
Cystophora gracilis	<10		
Lobospira bicuspidata	40		40
Pachydictyon paniculatum	50	20	50
Sargassum spp.		<10	
Callophyllis rangiferinus	280	15	
Champia obsoleta	80		
Dasya clavigera			<10
Griffithsia teges	260		
Hypnea sp.	40		
Laurencia filiformis f. *heteroclada*	290		
Liagora harveyiana	<10		
Polysiphonia nigrita	<10		
Total coverage	100	100	100
Biomass g/m²	3,950	2,840	4,330 [1,900]
Number of species	14	4	5

In each case the biomass value of the species characterising the community is in bold type.

* This sample was taken from a distinct *Jania* community at a depth of about 0.5 m (see Fig. 4).

north or east) and subject to strong to moderate water movement, forms an almost pure community completely covering the rock surface. In calmer areas a *Jania fastigiata* community, presenting a somewhat similar aspect of short, tufted plants, replaces the *Corallina*. The *Corallina cuvieri* community extends upwards into the lower eulittoral zone of the intertidal in rough-water situations, as described by Womersley & Edmonds (1958, p. 232).

Cystophora intermedia forms a fairly pure community under slightly less extreme water movement than *Corallina*, and also on sloping (rather than horizontal) surfaces subject to somewhat lower light intensity. While *Cystophora intermedia* may be dominant in such situations, in lower light intensity *Myriodesma harveyanum* becomes co-dominant, with numerous associated species of green, brown and red algae (see Table 1).

Cystophora intermedia is rare within the *Corallina cuvieri* community, but may be common near the upper and lower boundaries of this community. Its occurrence at the upper limit (i.e. near low tide level) agrees with the observations of Womersley & Edmonds (1958) that it marks the sublittoral fringe, but at St Francis I. it is not confined to this zone, occurring also as deep as 3 m.

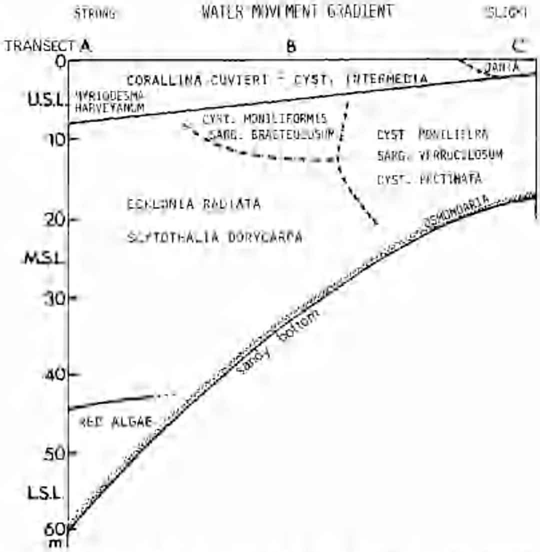

Fig. 5. Change in vegetation patterns along water movement and depth gradients.

2. Mid sublittoral zone

As at West I. and Pearson I., this zone on St Francis I. is characterised by larger brown algae 30 cm–1 m in height, forming an upper canopy or stratum over a lower stratum mainly of red algae 5–25 cm in height. The upper limit of this zone depends on the intensity of water movement as described for the upper sublittoral zone, and the lower limit on the limiting depth of large brown algae; this is about 45(–47) m deep on transect A. The vegetation profiles of Figs 2–4 represent the appearance of this zone on transects A, B, and C and the relations of the vegetation patterns with water movement are shown in Fig. 5. The average cover of the important upper stratum species is given in Fig. 6.

Several communities could possibly be recognised in this zone, but more extensive studies than were possible in the time available are needed to establish their validity. The dominants and understorey species will therefore be discussed more generally.

Ecklonia radiata and *Scytothalia dorycarpa* (Fig. 9) dominate this zone under conditions of considerable water movement at the rough-

TABLE 2

Biomass (g/m²) composition of mid sublittoral species in samples taken at certain depths on 3 transects. Further data on the vertical range of the species is given in the appendix

Transect	A			B			C			
Depth (m)	6	13	35	6	22	32	6	13	19	20
Area sampled (m²)	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Upper stratum										
**Ecklonia radiata*	2,200	300	1,800	450	900	1,200	—	1,050	250	740
**Scytothalia dorycarpa*	2,300	2,560	200	50	1,380	2,500	—	1,245	200	—
Cystophora pectinata	75	600	—	400	—	—	—	1,910	720	—
Cystophora moniliformis	—	—	—	420	—	—	—	—	—	—
Myriodesma harveyanum	—	—	—	250	—	—	—	—	—	—
Sargassum bracteolosum	—	315	P	510	180	—	—	P	15	90
Sargassum varians	75	—	200	120	—	—	10	250	340	—
Sargassum verruculosum	—	—	10	—	—	—	800	90	320	—
Sargassum linearifolium.	—	—	—	P	—	—	390	—	10	—
Sargassum heteromorphum	—	—	—	—	—	—	210	—	—	—
Sargassum decipiens	—	—	—	50	—	—	950	210	92	—
Cystophora brownii	—	—	—	P	—	—	110	P	—	—
Cystophora subfarcinata	—	—	—	P	—	—	220	720	280	—
Cystophora monilifera	—	—	—	—	—	—	560	330	710	—
Upper stratum coverage (%)	100	95	35	90	50	60	80	100	80	75
Upper stratum biomass (g/m²)	4,650	3,775	2,210	2,250	2,460	3,700	3,250	5,805	2,937	830
Lower stratum										
Brown algae										
Dictyopteris muelleri	—	—	P	—	30	—	5	P	6	—
Dictyota diemensis	—	—	P	30	—	—	10	—	5	—
Dictyota prolifera	—	—	50	—	130	—	—	—	5	—
Chlanidophora microphylla	—	—	—	—	180	—	—	—	25	80
Glossophora nigricans	—	—	P	—	90	—	—	—	—	—
Hydroclathrus clathratus	—	—	—	—	—	—	—	—	5	50
Lobospira bicuspidata	—	—	5	<5	—	—	610	75	6	—
Pachydictyon paniculatum	—	—	5	25	P	—	P	60	10	—
Zonaria spiralis	—	20	50	25	P	—	—	40	8	—
Zonaria sinclairii	—	—	50	—	600	—	—	—	4	—
Zonaria turneriana	—	30	P	—	—	—	—	—	—	—
Red algae										
Austrophyllis alcicornis	—	—	4	—	—	5	—	—	—	—
Ballia callitricha	—	—	4	—	—	40	—	—	—	—
Botryocladia obovata	—	—	—	—	—	—	—	—	50	60
Champia affinis	—	—	100	—	—	—	—	—	5	—
Cliftonaea pectinata	—	—	60	—	—	—	—	—	5	—
Delisea hypneoides	—	—	30	—	—	—	—	—	5	—
Delisea pulchra	—	—	105	340	P	—	—	—	—	—
Kallymenia cribrosa	—	—	20	—	—	—	—	—	—	—
Laurencia filiformis f. *dendritica*	—	—	80	—	—	—	—	—	—	—
Laurencia spp.	—	—	—	—	—	—	—	—	36	25
Osmundaria prolifera	—	—	—	—	—	—	410	40	1,020	3,400
Plocamium angustum	P	P	10	10	50	80	P	P	4	—
Plocamium cartilagineum	P	—	P	—	90	5	—	—	—	—
Plocamium mertensii	P	P	300	25	180	—	P	P	6	—
Plocamium preissianum	P	20	5	20	150	10	5	P	4	—
Pterosiphonia sp.	—	—	—	680	—	—	—	—	—	—
Rhodophyllis membranacea	—	—	5	—	50	—	—	—	—	—
Sonderophycus australis	—	—	—	—	10	10	—	—	—	—
Webervanbossea kaliformis	—	—	5	—	50	—	—	P	5	—
Biomass	—	70	888	1,160	1,610	150	1,040	215	1,214	3,615
Total number of species in sample	4	7	25	24	22	12	11	16	29	7
Total Biomass	4,650	3,845	3,098	3,410	4,070	3,850	4,290	6,020	4,151	4,445

* Values for *Ecklonia* and *Scytothalia* are mean values over 2–3 m².

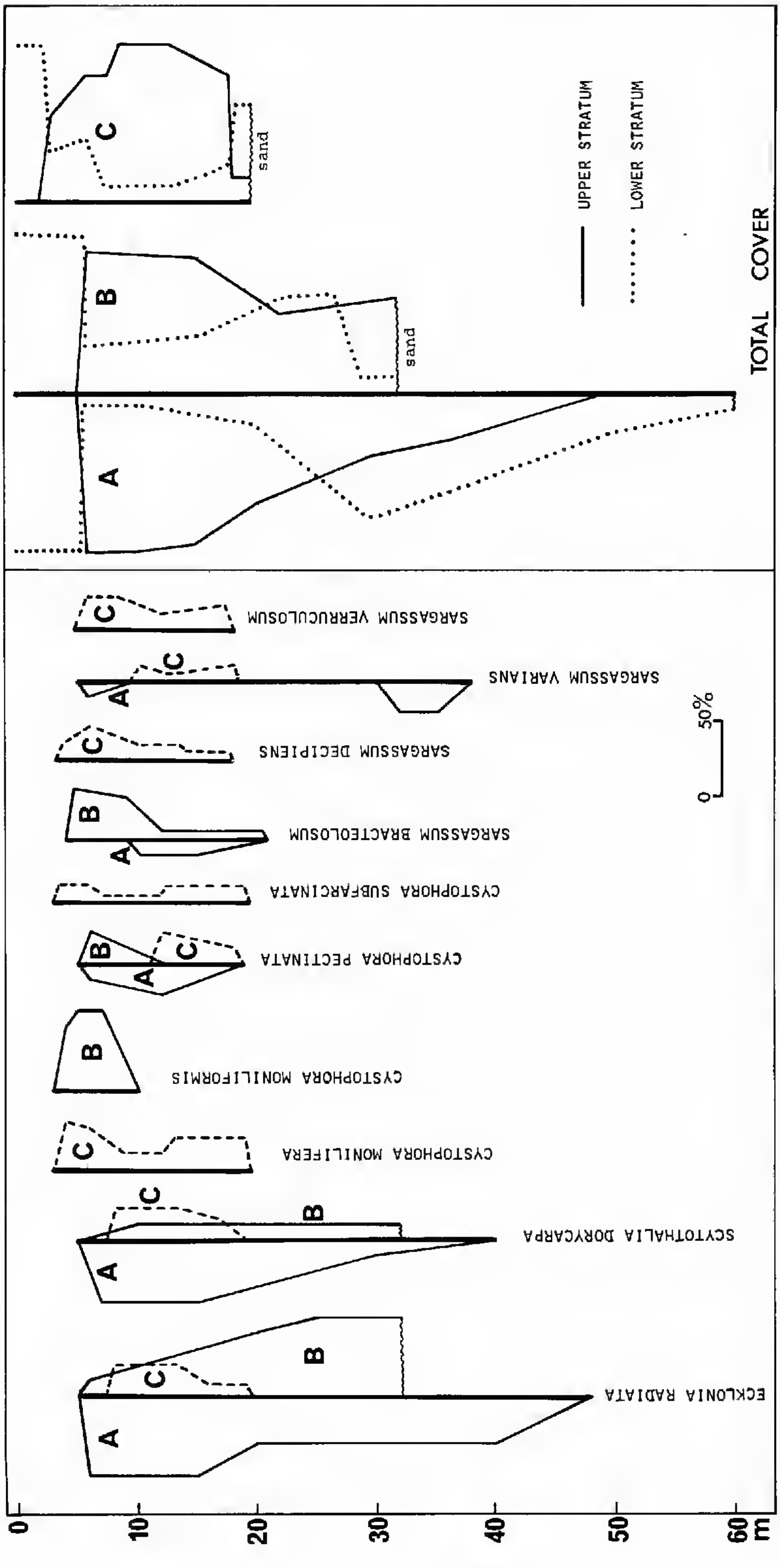

Fig. 6. Vertical distribution of % cover of prominent upper stratum species of the mid sublittoral zone, and total % cover of upper and lower strata on transects A, B and C.

water site (transect A, Fig. 2), but with less water movement (transect B, Fig. 3) other species of brown algae (*Sargassum bracteolosum* and *Cystophora moniliformis*) also become prominent. With greater shelter (transect C, Figs 4, 7, 8), *Cystophora monilifera*, *C. pectinata* and *Sargassum verruculosum* are common, together with *C. subfarcinata*, *Sargassum decipiens* and *S. varians*. These species are most common in the upper part of the mid sublittoral, with *Ecklonia* and *Scytothalia* still common in the lower part of this zone (Fig. 6).

Sargassum bracteolosum and *Cystophora moniliformis* on transect B, and *S. verruculosum* and *C. monilifera* on transect C, have similar vertical distributions, enabling field recognition of algal subzones dominated by these species pairs.

Understorey species are sparse over much of transects A and C, and moderately common only on transect B where the canopy is less dense. The distribution of many understorey species is too patchy to show any obvious relationship with either the distribution of upperstorey species or with apparent environmental factors.

The commonest understorey species are of *Plocamium* (*P. angustum*, *P. mertensii* and *P. preissianum*). They occurred on all three transects, with a vertical depth range of as much as 50 m; where they are rare or absent on horizontal surfaces, they are usually present on vertical ones.

Other species with a wide vertical range are *Caulerpa brownii*, *Lobospira bicuspidata* and *Pachydictyon paniculatum*; these species are known to be tolerant to a wide range of light intensity and of water movement. Some other species (e.g. *Glossophora nigricans*, *Austrophyllis alcicornis*, *Cliftonaea pectinata* and *Delisea hypneoides*) were found only in deeper water; most of these species occur also at West I. and Pearson I., with similar distribution in conditions of low light (and slight water movement at depth).

On transect C at 17–18 m depth (Fig. 4), there is an abrupt decline in the number of upper stratum species and their coverage, and an increase in coverage of several species of the lower stratum, e.g. *Osmundaria prolifera*, *Botryocladia obovata* and *Hydroclathrus clathratus*. This community forms a band 1–2 m wide lying immediately above the sandy bottom at about 20 m depth, and the species are apparently tolerant of the sedimentation which is pronounced over this narrow band.

The cover of upper and lower stratum species, with depth, is given in Fig. 6. Upper stratum cover is highest between 5 and 15 m depth, declining with depth, whereas lower stratum cover is lowest where the upper stratum is most dense, and in general increases with depth until light becomes limiting.

3. Lower sublittoral zone

Only on transect A does rocky substrate descend to sufficient depth for the lower sublittoral zone dominated by red algae (Shepherd & Womersley 1970, 1971) to occur. On this transect, a community (Fig. 10) of red algae together with bryozoa, sponges and hydroids, occurs between 47 and 57 m deep. The community is rich in algal species (but of low biomass), the most common being *Plocamium angustum*, *P. mertensii* and *P. preissianum*; several other species (*Rhodymenia australis*, *Gattya pinnella*, *Rhodocallis elegans* and *Kallymenia spinosa*) were found only in this collection. Algal cover in this community is low, averaging 10% (5-15%), indicating that 57 m is close to the depth (i.e. light) limit for most algae in this region.

B. THE SEAGRASS COMMUNITIES IN PETREL BAY

Three seagrass communities occur in this sheltered bay, forming bands around the bay dependent on substrate and depth.

Amphibolis antarctica fringes the shore from low water mark to 0.5 m below, attached by its rhizome-root system to calcareous reefs of low relief. Below these reefs the bottom is sandy, and at a depth of about 2 m, *Posidonia ostenfeldii* forms a fringe community about 20 m wide around the bay. Beyond this, descending to 22 m deep, *Posidonia australis* (narrow leaf form) is dominant in fairly continuous beds. Beyond about 22 m deep, *P. australis* becomes sparse, and at the time of the survey a loose-lying but apparently healthy community of the red alga *Hennedya crispa* occurred at this depth.

Fig. 7. Algal community at 8 m depth on transect C. Note *Cystophora monilifera* (top left), *Scytothalia dorycarpa* (top right) and several species of *Sargassum* (centre and lower right).

Fig. 8. Algal community at 10 m depth at transect C. Note species of *Sargassum* (centre left), *Ecklonia radiata* (top right) and *Cystophora monilifera* (centre and lower right).


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Discussion

Algal zones within the sublittoral, and the distribution, cover and biomass of the component species, have been described for many coasts elsewhere in the world. Recent accounts are those of Lüning (1970) from Helgoland, Boudouresque (1971) from the Mediterranean, and Mann (1972) from the Atlantic coast of Canada. These and other accounts show that broad algal zones, correlated with light intensity and the degree of water movement, occur in the photic zone on most coasts.

Although limited in extent, this survey of the subtidal algal vegetation of St Francis I. shows a similar zonation pattern to that at West I. and Pearson I. (Shepherd & Womersley 1970, 1971). As at these islands, the vertical extent of the upper sublittoral zone, and to a lesser extent the mid sublittoral, is dependent on the degree of water roughness (with which light penetration is also associated). The extent of the upper sublittoral zone probably corresponds with the depth to which "white water" (i.e. turbulent water carrying air bubbles) penetrates under average swell conditions. Riedl & Forstner (1968) considered the vertical height of their "inner surf zone" (Riedl 1971) to correspond to 2.5 x wave height, and this could also be applied to the upper sublittoral zone on South Australian coasts where wave heights are 1.5–2 m in a moderate swell. Chapman (1967) in discussing the presence of a sublittoral fringe in many parts of the Pacific is largely referring to this upper sublittoral zone. The term "sublittoral fringe" is best restricted to the zone emergent during suck back of waves at low tide, when this zone is ecologically distinctive (Womersley & Edmonds 1952).

The mid sublittoral zone at St Francis I. shows similar features to this zone at West I. and Pearson I., being dominated by the larger brown algae and with an understorey of mainly red algae. Further studies may show that distinct communities could be recognised in this zone, since competition between the various dominant species is apparent, and, over the considerable depth range, both light intensity and degree of water movement vary considerably. While most species show typical "bell-shaped" distribution patterns (as discussed by Whittaker 1967), some (e.g. *Cystophora monilifera*, *C. subfarcinata*) apparently show slightly bimodal distributions (Fig. 6), probably due to competition with other species better suited to the environment within their extremes.

The lower sublittoral zone of red algae was observed only in depths of 47–57 m at St Francis I., corresponding to the situation at Pearson I. rather than at West I., and reflecting the clarity of the water. This zone lies below the light intensity necessary for the larger brown algae and grades to the lower photic levels of the red algae. At St Francis I., intermixing of lower sublittoral red algae with fauna such as bryozoa, sponges and hydroids, was more prominent than at West I.

Although sublittoral zones are well defined at St Francis I., this characteristic is emphasized by choice of transects on steeply sloping shores involving steep light and water movement gradients. On more irregular shores, distinct zonation is less apparent.

Apart from ecological differences associated with depth, which reflect mainly the decrease in light intensity, light relationships are apparent in the mid sublittoral zone where a dense upper canopy may reduce the light reaching the lower stratum by up to 95%. This effect was well shown on transect A at 5–15 m depth and transect C at 7–13(–15) m depth, where a dense canopy covered a sparse understorey. Where a dense canopy exists with considerable water movement, reduction of the understorey may also be due to the physical effect of the larger fronds sweeping over the rock.

The effect of sediment (fine sand or silt stirred up in stormy weather and settling on the seabed under calmer conditions) was evident in two places. Near the end of transect B, at about 30 m depth, sediment is present on rocky surfaces and here there is an abrupt decline in cover of the lower stratum. At the end of transect C at 18(–20) m depth, where sediment also covers the rocky bottom, there is a distinctive community of certain red algae (*Botryocladia obovata*, *Osmundaria prolifera*) which can tolerate sediment. The effect of sedi-

Fig. 9. Algal community at 16 m depth on transect C. Note *Ecklonia radiata* (top right and lower left) and *Scytothalia dorycarpa* (centre).

Fig. 10. Sparse red algal community at 57 m depth on transect A.

ment in inhibiting algal colonisation and growth has been recently discussed by Grigg & Kiwala (1970).

The survey of St Francis I. was limited in time, the area covered, and in the variety of habitats sampled. Nevertheless, the subtidal algal flora appears fairly rich, with some 138 species recorded, compared to 160 for Pearson I. and 132 for West I. Further studies would certainly extend this number considerably.

Appendix: Algal species list

Identifications are by H. B. S. Womersley, Dr G. T. Kraft (Mychodeaceae, Dicranemaceae and Acrotylaceae) and Dr E. M. Wollaston (Crouanieae).

CHLOROPHYTA	
Caulerpales	
Caulerpa brownii (C.Ag.) Endlicher	A, 0–2, 32–38; B, 4–7; C, 2–6, 19
Caulerpa cactoides (Turn.) C. Agardh	A, 32–38; D, 2
Caulerpa flexilis Lamouroux	A, 32–38; D, 2
Caulerpa flexilis Lamouroux var. *muelleri* (Sond.) Womersley	B, 6–18; C, 6, 19
Caulerpa hedleyi W. v. Bosse	A, 32–38, 55
Caulerpa longifolia C.Ag. f. *crispata* (Harv.) Womersley	D, 2
Caulerpa obscura Sonder	D, 2
Caulerpa papillosa J. Agardh	A, 2; D, 2
Caulerpa scalpelliformis (R.Br.) C. Agardh	A, 35; B, 13–18; C, 19; D, 2
Caulerpa simpliciuscula (Turner) J. Agardh	A, 32–38; C, 10–13
PHAEOPHYTA	
Dictyotales—Dictyoteae	
Dictyota diemensis Kuetzing	A, 32–38; B, 6; C, 6, 19
Dictyota furcellata (C.Ag.) J. Agardh	A, 35
Dictyota prolifera Lamouroux	A, 32–38; B, 13–22; C, 19
Dilophus fastigiatus Sonder	B, 22; C, 19
Dilophus robustus (J.Ag.) Womersley	A, 32–38; B, 13–18
Pachydictyon paniculatum J. Agardh	A, 2, 35; B, 0–7, 22; C, 2–19; Masillon I. in bay, 1–4
Pachydictyon nov. sp?	B, 13-18
Glossophora nigricans (J.Ag.) Womersley	A, 32–38, 55; B, 13–22
Lobospira bicuspidata Areschoug	
Zonarieae	A, 2, 35; B, 6, 13–18; C, 6–19
Chlanidophora microphylla (Harv.) J. Agardh	B, 22; C, 19–20
Dictyopteris muelleri (Sond.) Reinbold	A, 32–38; B, 22; C, 6–19
Lobophora variegata (Lamx.) Womersley	B, 13–18
Zonaria crenata J. Agardh	A, 32–38
Zonaria sinclairii Hooker & Harvey	A, 10, 32–38; B, 13–22; C, 19
Zonaria spiralis (J.Ag.) Papenfuss	A, 13, 32–38; B, 6–22; C, 10–19
Zonaria turneriana J. Agardh	A, 13, 32–38
Nov. gen?	A, 32–38
Chordariales—Chordariaceae	
Corynophlaea cystophorae J. Agardh	C, 10–18, on *Cystophora brownii*
Bactrophora filum (Harv.) J. Agardh	C, 19–22; D, 3, 4, on *Posidonia australis* and *P. ostenfeldii*
Bactrophora vermicularis J. Agardh	C, 6
Polycerea nigrescens (Harv. ex. Kuetz.) Kylin	C, 6, 19–20; D, 3, 4, on *Posidonia australis* and *P. ostenfeldii*
Sporochnales—Sporochnaceae	
Bellotia eriophorum Harvey	A, 32–38; B, 13–18
Sporochnus comosus C. Agardh	A, 32–38
Dictyosiphonales—Giraudyaceae	
Giraudya sphacelarioides Derbes & Solier	D, 3, on *Posidonia australis*
Punctariaceae	
Hydroclathrus clathratus (C.Ag.) Howe	C, 19–20
Laminariales—Alariaceae	
Ecklonia radiata (C.Ag.) J. Agardh	A, 5–38; B, 5–32; C, 8–20
Fucales—Cystoseiraceae	
Scytothalia dorycarpa (Turn.) Greville	A, 6–38; B, 4–32; C, 8–19, Masillon I. in bay, 1–4
Cystophora brownii (Turn.) J. Agardh	B, 4–7; C, 2–13
Cystophora intermedia J. Agardh	A, 0–2; C, 0–3

Cystophora gracilis Womersley & Nizamuddin	B, 4–7
Cystophora monilifera J. Agardh	A, 0–2; C, 2–19
Cystophora moniliformis (Esper) Womersley & Nizamuddin	B, 4–7
Cystophora pectinata (Grev. & C.Ag.) J. Agardh	A, 6, 13; B, 6–18; C, 10–19
Cystophora subfarcinata (Mert.) J. Agardh	B, 6; C, 0–13, 19. Masillon I. in bay, 1–4
Myriodesma harveyanum Nizamuddin & Womersley	A, 2; B, 4–7
Sargassaceae	
Phyllotrichia	
Sargassum decipiens (R.Br.) J. Agardh	B, 6; C, 2–19
Sargassum heteromorphum J. Agardh	C, 2–4, 6
Sargassum varians Sonder	A, 6, 32–38; B, 6–18; C, 6–19
Sargassum verruculosum (Mert.) Agardh	A, 35; B, 13–18; C, 2–19
Arthrophycus	
Sargassum bracteolosum J. Agardh	A, 13, 32–38; B, 4–22; C, 10–19; D, 2
Sargassum lacerifolium (Turn.) Agardh?	A, 12, 32–38
Sargassum tristichum Grev. & Agardh ex Sonder	Masillon I. in bay, 1–4
Eusargassum	
Sargassum linearifolium (Turn.) Agardh?	B, 4–7; C, 6, 19
Sargassum podacanthum Sonder?	A, 32–38
Sargassum spinuligerum Sonder	A, 35
Sargassum distichum Sonder	A, 35
Sargassum (Eusargassum, tribe Glomerulatae?)	C, 10–13
RHODOPHYTA	
Nemaliales—Chaetangiaceae	
Galaxaura spathulata Kjellman	A, 32–38; B, 22. Masillon I. in bay, 1–4
Helminthocladiaceae	
Liagora harveyiana Zeh	A, 2
Bonnemaisoniaceae	
Asparagopsis armata Harvey	A, 10, 32–38; B, 4–18
Delisea hypneoides Harvey	A, 32–38; B, 13–18; C, 19
Delisea pulchra (Grev.) Montagne	A, 10, 32–38; B, 6–22
Gelidiales—Gelidiaceae	
Pterocladia lucida (R.Br.) J. Agardh	B, 4–7, Masillon I. in bay, 1–4
Cryptonemiales—Dumontiaceae	
Acrosymphyton taylori Abbott	A, 32–38
Squamariaceae	
Sonderophycus australis (Sond.) Denizot	B, 13–32
Corallinaceae (excluding encrusting taxa)	
Amphiroa anceps (Lamarck) Decaisne	A, 32–38; B, 13–18, 32; C, 10–19
Jania fastigiata Harvey	C, 0–2
Jania micrarthrodia Lamouroux?	D, 3 on *Posidonia australis*
Jania pusilla (Sond.) Yendo	B, 4–7; Masillon I. in bay 1–4 on *Cystophora subfarcinata*
Jania sp.	A, 32–38
Corallina cuvieri Lamouroux	B, 6
Corallina cuvieri f. crispata Lamouroux	B, 0–6; C, 0–6; D, 2
Metagoniolithon charoides (Lamx.) W. v. Bosse	C, 6–19
Metagoniolithon stellifera (Lamarck) W. v. Bosse	D, 2 on *Amphibolis antarctica*
Polyporolithon patena (H. & H.) Mason	B, 13–18 on *Ballia callitricha*
Cryptonemiaceae	
Carpopeltis phyllophora (H. & H.) Schmitz	A, 32–38, Masillon I. in bay, 1–3
Cryptonemia undulata Sonder	D, 2
Halymenia harveyana J. Agardh	B, 13–18; C, 10–13
Thamnoclonium dichotomum (J.Ag.) J. Agardh?	A, 32–38
Grateloupiaceae	
Gelinaria ulvoidea Sonder	C, 19–20
Kallymeniaceae	
Austrophyllis alcicornis (J.Ag.) Womersley & Norris	A, 32–38; B, 13–18, 32
Callophyllis rangiferinus (Turn.) Womersley	A, 2–10; B, 0–7; C, 10–13
Callophyllis lambertii (Turn.) J. Agardh	A, 55
Kallymenia cribrosa Harvey	A, 32–38; B, 13–22
Kallymenia spinosa Womersley & Norris	A, 55
Thamnophyllis lacerata Womersley & Norris	A, 32–38
Gigartinales—Plocamiaceae	
Plocamium angustum (J.Ag.) Hooker & Harvey	A, 6–55; B, 6–32; C, 6–19

Plocamium cartilagineum (L.) Dixon	A, 6–10, 32–38, 55; B, 13–22, 32
Plocamium leptophyllum Kuetzing	A, 55
Plocamium mertensii (Grev.) J. Agardh	A, 6–55; B, 6–22; C, 6–19
Plocamium preissianum Sonder	A, 6–55; B, 6–32; C, 6–19
Solieriaceae	
Solieria robusta (Grev.) Kylin	A, 32–38; C, 20; D, 4
Rhabdoniaceae	
Areschougia congesta (Turn.) J. Agardh?	A, 32–38
Rhodophyllidaceae	
Rhodophyllis membranacea (H. & H.) Harvey	A, 35; B, 13–22
Rhodophyllis ramentacea (C.Ag.) J. Agardh	A, 32–38; B, 32
Hypneaceae	
Hypnea episcopalis Hooker & Harvey	B, 6; C, 10–13
Hypnea sp.	A, 2; B, 4–6
Mychodeaceae	
Mychodea pusilla (Harv.) J. Agardh	D, 2, on *Amphibolis antarctica*
Mychodea ramulosa J. Agardh	B, 4–7
Mychodea carnosa Hooker & Harvey	A, 32–38
Neurophyllis australis Zanardini	C, 19–20
Dicranemaceae	
Dicranema revolutum (C.Ag.) J. Agardh	D, 2, on *Amphibolis antarctica*
Acrotylaceae	
Hennedya crispa Harvey	D, 24, loose-lying
Rhodymeniales—Rhodymeniaceae	
Fauchea?	A, 32–38
Webervanbossea kaliformis (J.Ag.) J. de Toni	A, 32–38; B, 22; C, 10–13, 19
Webervanbossea splachnoides (Harvey) J. de Toni	A, 32–38; C, 19–20
Botryocladia obovata (Sonder) Kylin	C, 19–20
Coelarthrum cliftonii (Harv.) Kylin	A, 32–38
Coelarthrum meulleri (Sond.) Boergesen	A, 35
Gloiosaccion brownii Harvey	B, 13–18; C, 10–13
Rhodymenia australis (Sond.) Harvey	A, 32–38, 55; D, 2
Lomentariaceae	
Champia affinis (H. & H.) J. Agardh	A, 32–38; B, 13–18; C, 19
Champia obsoleta Harvey	A, 2
Champia tasmanica Harvey	A, 32–38
Ceramiales—Ceramiaceae	
Crouanieae	
Gattya pinella Harvey	A, 55
Gulsonia annulata Harvey	C, 19–20
Antithamnieae	
Acrothamnion preissii (Sond.) Wollaston	B, 13–18, on *Ballia callitricha*
Antithamnion divergens (J.Ag.) J. Agardh	A, 55
Ballia ballioides (Sond.) Wollaston	A, 55
Ballia callitricha (Ag.) Kuetzing	A, 35; B, 13–18, 32
Ballia mariana Harvey	A, 55
Platythamnion nov. sp?	A, 55
Griffithsieae	
Griffithsia teges Harvey	A, 2
Callithamnieae	
Callithamnion sp.	A, 32–38
Callithamnion sp.	A, 55
Dasyphileae	
Rhodocallis elegans Kuetzing	A, 55
Delesseriaceae	
Apoglossum tasmanicum (F.v.M.) J. Agardh	B, 32
Dasyaceae	
Dasya clavigera (Wom.) Parsons	C, 0–2; D, 2–4
Dasya naccarioides Harvey?	C, 19–20
Rhodomelaceae—Polysiphonieae	
Polysiphonia nigrita Sonder	A, 2
Pterosiphonieae	
Pterosiphonia sp.	B, 6
Herposiphonieae	
Dipterosiphonia? nov. sp?	B, 13–18
Herposiphonia nov. sp?	A, 55

Polyzonieae	
Cliftonaea pectinata Harvey	A, 32–38; B, 13–18; C, 19
Amansieae	
Osmundaria prolifera Lamouroux	B, 13–18; C, 6–20
Laurencieae	
Laurencia elata (Ag.) Harvey	B, 13–18
Laurencia filiformis (Ag.) Montagne f. *dendritica* Saito & Womersley	A, 32–38
Laurencia filiformis (Ag.) Montagne f. *heteroclada* Saito & Womersley	A, 0–2; C, 19–20
Laurencia paniculata (Ag.) J. Agardh	C, 19–20
SPERMATOPHYTA—seagrasses	
Potamogetonaceae	
Heterozostera tasmanica (Mart. ex Aschers) den Hartog.	D, 3
Posidonia australis J. D. Hooker—narrow and broad forms	C, 19–22; D, 3–4
Posidonia ostenfeldii den Hartog	D, 3, Masillon I. in bay 6–9
Amphibolis antarctica (Labill.) Sonders ex Aschers	D, 2

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